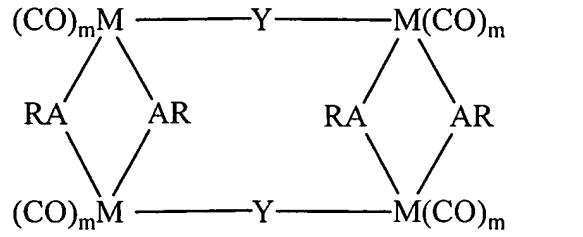


**WHAT IS CLAIMED IS:**

1. A rectangular supramolecule having the following structure:



wherein

M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os;

5 Y is a nitrogen-based didentate ligand;

A is O, S, Se, or Te;

R is C<sub>3</sub>~C<sub>16</sub> alkyl, (CH<sub>2</sub>)<sub>n</sub>-aryl, or (CH<sub>2</sub>)<sub>n</sub>-aryl-(O-C<sub>1</sub>~C<sub>16</sub> alkyl)<sub>p</sub>, in which n is 0-15, p is 1-3; and

m is 1, 2, 3, 4, or 5.

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2. The rectangular supramolecule of claim 1, wherein M is Re.

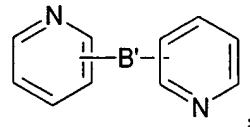
- 15 3. The rectangular supramolecule of claim 2, wherein m is 3.

4. The rectangular supramolecule of claim 1, wherein R is C<sub>3</sub>~C<sub>16</sub> straight chain

alkyl.

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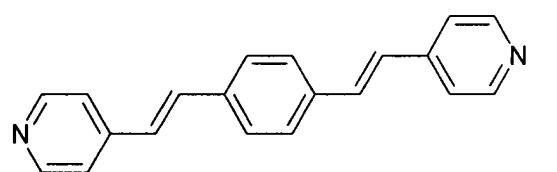
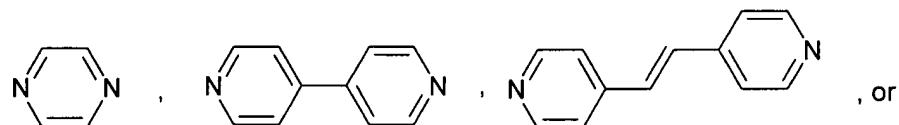
5. The rectangular supramolecule of claim 1, wherein A is O.
6. The rectangular supramolecule of claim 1, wherein Y is diazine or a ligand of the formula:



wherein B' is a bond, alkyl, alkenyl, alknyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

7. The rectangular supramolecule of claim 6, B' is a bond, alkenyl, alknyl, or  
5 aryl.

8. The rectangular supramolecule of claim 6, wherein Y is

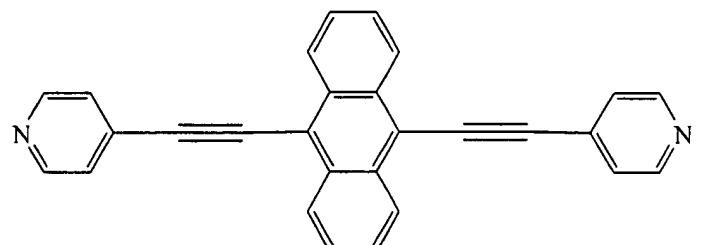
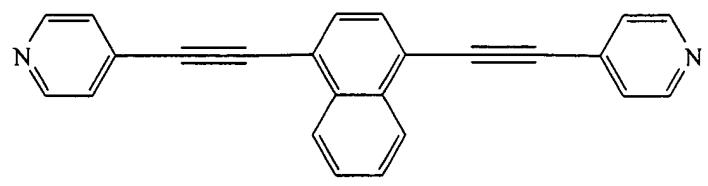
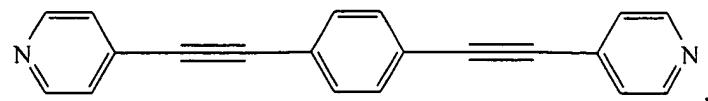
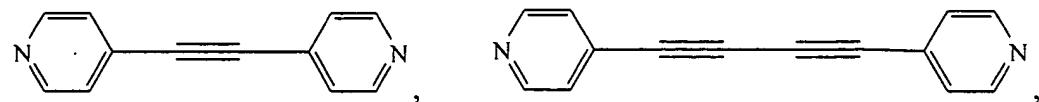


10 9. The rectangular supramolecule of claim 6, wherein M is Re, and m is 3.

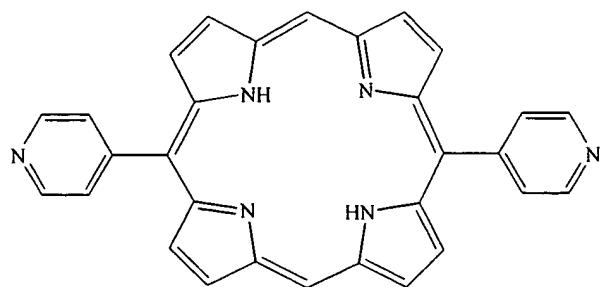
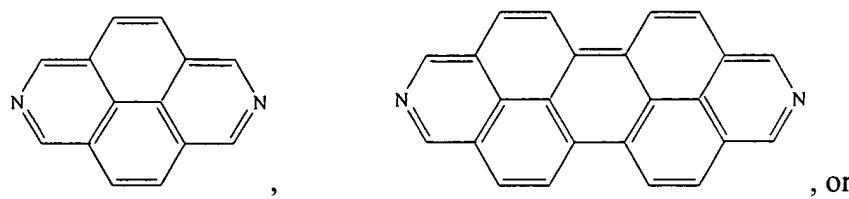
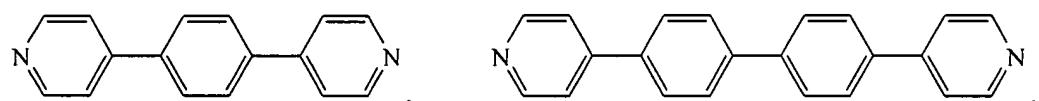
10. The rectangular supramolecule of claim 6, wherein R is C<sub>3</sub>~C<sub>16</sub> straight chain  
alkyl.

15 11. The rectangular supramolecule of claim 6, wherein A is O.

12. The rectangular supramolecule of claim 6, wherein Y is

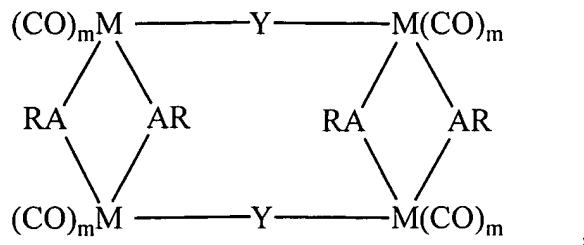


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13. A method for making a rectangular supramolecule having the following structure:



wherein M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os; Y is a nitrogen-based didentate ligand; A is O, S, Se, or Te; R is C<sub>1</sub>~C<sub>16</sub> alkyl, (CH<sub>2</sub>)<sub>n</sub>-aryl, or (CH<sub>2</sub>)<sub>n</sub>-aryl-(O-C<sub>1</sub>~C<sub>16</sub> alkyl)<sub>p</sub>, in which n is 0-15, p is 1-3; and m is 1, 2, 3, 4, or 5;

the method comprising:  
reacting M(CO)<sub>m+2</sub> with a nitrogen-based didentate ligand in the presence of an RAH at an elevated temperature to form the rectangular supramolecule.

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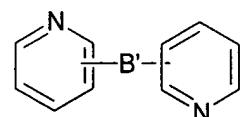
14. The method of claim 13, wherein M is Re and m is 3.

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15. The method of claim 13, wherein RAH is a C<sub>1</sub>~C<sub>16</sub> aliphatic alcohol.

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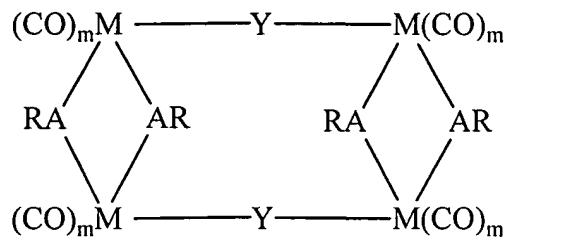
16. The method of claim 13, wherein Y is diazine or a ligand of the formula:



wherein B' is a bond, alkyl, alkenyl, alkynyl, cyclyl, heterocyclyl, aryl, or heteroaryl.

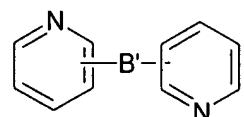
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17. A composition for emitting luminescence at room temperature, comprising:  
a rectangular supramolecule having the following structure:



wherein M is Re, Mn, Cr, Mo, W, Fe, Ru, or Os; Y is a nitrogen-based didentate  
5 ligand; A is O, S, Se, or Te; R is C<sub>1</sub>~C<sub>16</sub> alkyl, (CH<sub>2</sub>)<sub>n</sub>-aryl, or (CH<sub>2</sub>)<sub>n</sub>-aryl-(O-C<sub>1</sub>~C<sub>16</sub> alkyl)<sub>p</sub>,  
in which n is 0-15, p is 1-3; and m is 1, 2, 3, 4, or 5; and  
an aqueous solution.

18. The composition of claim 17, wherein M is Re and m is 3.  
10  
19. The composition of claim 17, wherein R is C<sub>1</sub>~C<sub>16</sub> straight chain alkyl.  
20. The composition of claim 17, wherein A is O.  
15  
21. The composition of claim 17, wherein Y is diazine or a ligand of the formula:



wherein B' is a bond, alkyl, alkenyl, alkynyl, cyclyl, heterocyclyl, aryl, or heteroaryl.